from the west appear to control the changes and motions in the special temporary areas of low pressure. Indeed the latter appear to owe their very existence to the flow of air over the chain of high mountains and the resulting formation of eddies. Eddies rotating around horizontal axes form cloud and rain on the east, but foehn winds and pamperos on the west of the axis. Eddies around vertical or inclined axes constitute low pressures whose perpetuity and development depend almost wholly upon the question whether the rising air with cloud and rain is on the east side or the west side of the circulation. The general tendency of the low areas is to move southeastward toward the coast of Chile and Argentina and then if they live, to pass northeastward over the east coast.

BRAZIL.

The Department of Marine of the United States of Brazil has for the past nine years published a monthly bulletin, giving in full the results of the daily observations at various hours, including Greenwich mean noon observations, taken at a number of stations along the eastern coast, and a few in the interior. In addition to the strictly meteorological features the bulletin gives the results of the magnetic observations made at the central station, Moro de San Antonio, Rio Janeiro. The work for each six months is summarized in semiannual volumes, the periods covered being October–March and April–September respectively. This work is under the immediate supervision of Captain Americo Silvado, of the Brazilian Navy.

The State of São Paulo has had an independent meteorological service since 1886, under the direction of the Commissão Geographica e Geologica de São Paulo, publishing the results of its observations in an annual volume of Dados Climatologicos. General observations are made at the hours of 7, 2, and 9, at about twenty stations, and rainfall observations at several others.

At Juiz de Fora, in the State of Minas Geraes, an independent observatory has been maintained by the municipality since 1893, and has published its observations.

BOLIVIA.

The Sociedad Geografica de La Paz regularly publishes observations made at La Paz. The bulletin of this society has also occasionally contained summaries of observations at other places in Bolivia, among which are Sucre, Oruro, and Trinidad. Private individuals have published observations at Potosi and Cochabamba.

GUIANA.

In British Guiana a fairly complete system of rainfall observations is maintained throughout the colony under the direction of the Government Botanic Garden at Georgetown. In Georgetown itself records of temperature, sunshine, and rainfall are kept up; the record of the latter element extends back to 1880. The observations are published in the Report on Botanic Gardens, Georgetown.

A first-class meteorological observatory is maintained at Cayenne, French Guiana, the data from which are published in the Annales of the Bureau Central Meteorologique de France.

For Dutch Guiana (Colony of Surinam) the Meteorological Jaarboek of the Netherlands has contained, since 1880, daily observations taken at Paramaribo. The French Annales gives an annual summary of monthly means of observations at Burnside-Coronie.

COLOMBIA.

Colombia has a Meteorological Office, but no reports have been received recently. Monthly totals of rainfall, number of rainy days, and greatest fall in 24-hours for Cartagena are published in the Annales of the Bureau Central Meteorologique de France.

ECUADOR.

The Observatorio Astronomico y Meteorologico de Quito seems to be the only meteorological observatory in Ecuador. It publishes an annual résumé of meteorological observations, of which the first volume, for September, 1895, to October, 1896, has been received.

URUGUAY.

In Uruguay the Jesuit Colegio Pio de Villa Colon has maintained a meteorological station of the first order near Montevideo since 1883. The Meteorological Society of Uruguay, established in 1890, maintains a number of second order and rain stations and publishes the results in its Resumen de las Observationes Pluviometricas.

E. D. ARCHIBALD AND THE MODERN KITE.

The Editor regrets that by a slip of the pen in the second column of page 257 of the MONTHLY WEATHER REVIEW for June, "Abercromby" was published instead of "Archibald." The great work done by E. D. Archibald in 1883 in the way of reviving the use of the kite for meteorological purposes was mentioned in the MONTHLY WEATHER REVIEW for 1895 and 1896, but lest modern readers should forget what we owe to him we may add that Archibald carried out a systematic series of observations with anemometers at different heights above the ground during 1883, 1884, and 1885. He used steel music wire as a kite line almost from the start in 1883, and attained heights up to 1500 feet above the ground. He also invented and patented in 1885 the kite balloon to which he gave that name. A combination of the kite and the balloon that we believe was the first ever made.

Mr. A. Lawrence Rotch was present at one of the first flights at Tunbridge Wells, and in 1887 Mr. Archibald took a photograph from a kite, which is also one of the first if not the very first occasion on which that was done. The great improvements that have been made in kite work by Mr. Rotch, the Weather Bureau, and various investigators all over the world have been the natural outcome of Mr. Archibald's demonstration of the general utility of the idea. He may fairly claim to have started the modern systematic kite flying with steel wire for scientific purposes. At the meeting of the British Association for the Advancement of Science in 1884 at Montreal, he brought the importance of the subject prominently to the attention of those present and ventured to predict an important future for this method of studying the atmosphere. His name should replace that of Abercromby on page 257.

THE MOUNT WEATHER OBSERVATORY.

In response to a correspondent inquiring about the Mount Weather Observatory, the Chief of Bureau has lately replied as follows:

The Mount Weather Observatory is not for solar physics alone, nor are the forecasts of the U. S. Weather Bureau likely to be founded upon solar observations only, but upon the data and study of the atmosphere itself.

The Weather Bureau makes forecasts of weather and of floods that are of general and sometimes of critical importance to agriculture, commerce, and many other human interests. These forecasts depend upon our knowledge of a branch of science whose field is the study of the earth's atmosphere as a whole.

Recent research has shown that there is a possibility of improving these forecasts by a more complete study of the changes going on in the radiation that we receive from the sun, but this is a minor matter compared with the study of the so-called waves of temperature, pressure, and moisture that pass over the earth's surface, and the mechanical laws that govern the movements of the air. As progress in our knowledge of the mechanics of the earth's atmosphere can only be made by means of daily weather charts, laboratory experiments, and mathematical study, therefore the U. S. Weather Bureau has established a meteorological institution of broad scope, designated as the Mount Weather Ob-

servatory, at which every branch of investigation and study bearing on the atmosphere will be pursued, especially (1) observations of the upper strata of the air by means of kites and balloons, (2) observations of the clouds by the nephoscope, (3) experiments in the physical laboratory on the motions of small masses of air under conditions that are precisely known, (4) observations of the total radiation from the sun by means of actinometers and bolometers, (5) details of the solar condition recorded by apparatus at the solar physical observatory, (6) records of the electrical and magnetic phenomena of the earth and atmosphere, and (7) particularly the education of special students in the interpretation of all these observations by means of the higher mathematics, so that the results of the knowledge thus gained may advance meteorology and improve the weather forecasts.

This recognizes that behind every practical art of doing there must be a higher science of studying and knowing.

IMPORTANCE OF RESEARCH OBSERVATORIES FOR THE PROMOTION OF METEOROLOGY.

The public is familiar with the idea that it is a fine thing to establish great hospitals, universities, libraries, churches, technical schools, and other institutions that minister to the practical needs of mankind, but very few have as yet awakened to realize the fundamental importance of institutions for the increase of knowledge, as distinguished from those that merely diffuse knowledge or from many others that apply knowledge to ameliorate the condition of mankind. We often think of our public institutions as marking the great difference between the present and the past ages, but the ancients had their asylums and hospitals, their irrigation systems, their machinery, aqueducts, sewers, and other ways of applying whatever knowledge they had.

The fundamental difference between the present age and all previous time is not the school nor the asylum, but the enormous increase in our actual knowledge of nature in all her minutest and most complex workings. We must increase knowledge before we can teach it or apply it and to bring about this increase is the peculiar province of those men who devote themselves to research so-called. A few names distinguished for research come down to us from antiquity, such as Archimedes, Eratosthenes, Pliny, Aristotle. Doubtless there were others whose names have been forgotten, but in modern times the number has been immensely increased since the days of Copernicus, Galileo, Newton, Huyghens, and Descartes.

Science is sometimes said to be a systematic arrangement of our knowledge of nature as distinguished from the vague and erroneous traditions and guesses of less fortunate times; but modern science is more than an arrangement of knowledge—it is research for the purpose of increasing knowledge. No one can hold a high place in science unless it can be shown that he has on many occasions been able to elucidate with precision that which was previously imperfectly known or perhaps unsuspected. The best scientific men, or "researchers" as they have lately been called, are distinguished by an inborn and cultivated ability to concentrate their whole energies upon a solution of a definite problem until the work is done. Generally speaking they do not care so much for salaries or positions or the practical application of their knowledge, as they do for the opportunity of devoting their lives to the research work that they love. Such valuable men have to be provided for and for several centuries scientific societies and the better endowed universities as well as wealthy men have set aside small sums of money establishing fellowships or something equivalent for the support of those who have shown ability in research. In fact the German universities have for 90 years been animated more by the spirit of research than of instruction, and promotions therein have been based almost wholly on ability in original research.

There have been several notable illustrations of munificent foundations for the special benefit of research. Such was the Royal Institution of London organized about 1800 by that most brilliant American, Benjamin Thompson, Count Rumford. It has supported such eminent men as Sir Humphrey Davy, Michael Faraday, John Tyndall, and Lord Rayleigh.

Doubtless it was this successful foundation that led James Smithson to establish his great fund "for the increase and diffusion of knowledge" in which sentence he in fact quoted from Washington's farewell address. Possibly Smithson thought that in a free and peaceful republic scientific men would be less trammeled than in an aristocratic and warlike nation. He himself loved knowledge for its own sake but doubtless realized that to some "knowledge is wealth" to others "knowledge is power." Hitherto Americans like Peabody and Rockefeller have distinguished themselves by the endowment of education; Carnegie has given a great fund for research; Lick, Yerkes, McCormick, and others have given large sums for special research in astronomy, but we know of no one who has endowed research in meteorology. It has therefore become unavoidable that the Weather Bureau should solicit from the Federal Congress of the United States the funds needed for research in that difficult branch of science whose development is essential to the improvement of practical meteorology.

We quote the following appreciative remarks from an article by Dr. Frank Waldo, in the Boston Evening Transcript of August 19, 1905:

> Is there an honest and economical reason for this establishment? Being conversant with Weather Bureau conditions I am able to answer in the affirmative. It has been a long cherished desire on the part of all Government meteorologists to undertake the class of careful studies of the atmospheric conditions that have been pursued by some European governments. But a lack of proper facilities has, in a great measure, prevented such undertakings, their practical importance not being recognized by the "appropriating" powers who have been more interested in the matter of extending weather predictions to a wider circle of recipients, than in the slow increase of accuracy which might be expected to result from expensive studies and costly equipments. This feeling of economy went so far some years ago that the official publication of professional papers by the Weather Bureau was ordered discontinued. * * *
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> While great advances have been made in theoretical meteorology yet what has been most needed has been more accurate and more numerous observations of atmospheric conditions, not only over the world at large, but also in special locations. This last has necessitated the establishment of proper observatories.
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> Three kinds of special observatories have been erected in the prosecution of meteorological studies. First, a central observatory, which acts as a bureau institution for the ordinary observing stations such as are scattered over the country—whence the former may control the work of others and set them an example of the highest class of work in their line of observation. Such an observatory has been maintained at Washington from the beginning of our Weather Bureau, although its efficiency has greatly increased within recent years since the Bureau has had a building of its own. These observatories were mostly established in the capital cities.
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> But as the work of observational meteorology increased in accuracy, observatories were instituted at some distance from the disturbing influence of the towns. To this class belong the famous observatories of Kew, at Richmond, England, Pavlovsk in Russia, and Potsdam near Berlin. We had indeed one somewhat similar observatory in this country, Central Park, New York; but it was conducted on a meager scale and in its work did not attain the refinement of the great observatories of Europe. But we had no national observatory of that class.
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> As long ago as 1883 * * * the present writer was directed by Gen. W. B. Hazen, then the head of the Signal Service, to draw up plans for a small observatory of this class to be established at Fort Myer, Va., which was then the training school for the Signal Service men and was under control of that Service. By utilizing the temporary buildings already constructed at Fort Myer, only a few thousand dollars were needed for the proper housing and setting up the meteorological instruments. But even that petty sum was not forthcoming, chiefly owing to the objections in Congress.
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> Fort Myer has passed out of control of the Weather Bureau, and now twenty years after General Hazen's unsuccessful attempt Professor Moore has established such an observatory as the Weather Bureau has so long needed, only to be attacked by sensation mongers. What will these critics say when they are told that the best interests of practical meteorology require at least 25 such observatories located at different parts of the United States? The day will come when we shall have them. * * *
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> It is one of the anomalies of our educational system that weather